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SOME RESULTS ON FIELD EXPERIMENTATION WITH *TYPICA* X *NANA* F_1 HYBRIDS (2) COPRA AND OIL CONTENT

by

M. A. P. P. MANTHRIRATNA

Botanist,
Coconut Research Institute, Lunuwila, Sri Lanka

SUMMARY

Data are presented on weight of husked nuts, weight of copra (dried endosperm) and oil content of *typica* x *nana* hybrids where all three colour forms of the variety *nana viz. pumila, eburnea,* and *regia* have been used as male parents. The observed difference in weight of husked nuts is probably due to the contribution made by the shell and nut water, and not a reflection of the weight of endosperm. There is no appreciable difference in weight of copra or oil content in the F_1 hybrids. *Typica* x *nana* form *regia* hybrids had the highest oil content (69.4%), compared with *typica* x *nana* form *pumila* (68.6%), and *typica* x *nana* form *eburnea* (68.0%). Caution has to be exercised in the choice of parental material for the production of these hybrids.

INTRODUCTION

Among the different varieties and forms of the coconut palm (*Cocos nucifera* L), grown in Ceylon the form *typica* of the variety *typica* is by far the commonest, and would virtually account for the entire acreage under this crop. The "Ceylon typica" has a number of desirable characters including economically important ones such as weight of dried endosperm (copra) per nut, good copra outturn and high oil content, (Liyanage, 1958). In common with the 'tall' variety of palms in other coconut growing countries, the late flowering habit of the variety *typica* appears to be a disadvantageous character.

Plant breeders at various research stations have been aware of the necessity of producing strains of the coconut palm which are precocious in bearing and are also hgih-yielding. The character, early bearing, may be used to advantage in implementing national replanting programmes, where quick returns would enable the grower to recover the initial outlay in a short period of time. However, as precocity in bearing is not the only desirable character, (particularly in a perennial tree crop), the plant breeder has to evaluate other desirable attributes. The combined effect of these factors may be related to the end products, which, in the case of the coconut palm would mainly consist of copra (dried endosperm), or oil.

Intraspecific hybridization of coconuts has been in progress for over two decades chiefly in Ceylon, India. Ivory Coast and Jamaica, the emphasis being on the production of strains which bear early and are also high-yielding. The first generation hybrids involving the *typica* (tall) and the nana (dwarf) varieties have been under observation in Ceylon since 1950, (Liyanage, 1956). The rate of leaf production, period for initial flowering and yield of these hybrids when compared with *typica* palms have been reported in the first article of this series, (Manthriratna, 1971).

This paper reports on the productivity of the *typica* x *nana* hybrids in terms of copra (dried endosperm) weight and oil content. It further aims to assess the relative merits and suitability of the three colour forms of the variety *nana* viz: form *pumila* (dwarf green). form *eburnea* (dwarf yellow) and form *regia* (dwarf red) for the production of *typica* x *nana* and *nana* x *typica* hybrids.

(In the discussion, the term *typica x nana* is used only when referring to hybrids between the two varieties; where no distinction is made among the three colour forms of the *nana* variety used in the crosses).

METHOD

(a) **Production of experimental material:**—Selected high yielding palms from the Latin Square Selection Experiment, Ratmalagara Research Station, were used as female parents. These were crossed with dwarf male parents, selected on early flowering and nut size, from the Dwarf Palm Block and Hybrid Palms Block "A" at the above station.

The crossing programme was completed in 1956, and the technique used has been described earlier, (Manthriratna and Liyanage, 1960).

(b) **Layout of field experiment:**—225 seedlings from the above crosses were selected largely on vigour of the seedlings at the third-leaf stage and transplanted in 1958 at the Ratmalagara Research Station on the 'hedge plantation system' (Liyanage 1955), with a fully randomized distribution. Rows were spaced 26 feet (8 metres) apart, and within each row the seedlings were spaced at 18 feet (5.5 metres). This gave an initial density of 93 palms/acre, (229 palms/hectare). The plantation was subsequently thinned down to the conventional density of 64 palms/acre, (158 palms/hectare), based on growth and yield.

RESULTS AND DISCUSSION

The data relating to certain characters of the nuts of the F_1 progeny of the three types of *typica* x *nana* hybrids is presented in Table 1, and an analysis of variance for these characters in table 2. It will be observed from table 1 that the husked nuts of *typica* x *nana* form *pumila* progeny are heavier (mean weight 787 g.-28 oz.) than from those where the forms *eburnea* and *regia* have been used as pollen parents; (mean weight 673 g—24 oz. and 504 g—18 oz. respectively). However, as the nuts from the progeny of all three types of crosses produce 213—216 g. (7.5 oz.) of copra (table 1), the observed difference in weight of husked nuts is probably a reflection of the contribution made by the other components of the husked-nut such as the shell and the nut water. For these same reasons the analysis of variance, of husked nut weight (table 2(a)) shows a highly significant difference, ($P<0.01$) between types although this item is not significant when weight of copra per nut is considered (table 2 (b)).

Satyabalan *et al.* (1968) have reported that the nut and copra characters of the hybrids of *tall* x *dwarf* (orange) are far superior to those obtained where *dwarf* (green) was used as the male parent. Furthermore, it has been reported by these workers that there are no heterotic effects in weight of unhusked nut, but there is marked heterosis for weight of husked nut. From an analysis of nut characters of the F_1 hybrids of *West Coast Tall* x *Dwarf Orange* and *West Coast Tall* x *Gangabondam*, Satyabalan, Ratnam & Kunjan, (1970), state that there is heterosis for nut water content, and kernel weight, and in the case of *West Coast Tall* x *Dwarf Green* for shell content as well. The degree of heterosis for the different nut characters have not been estimated for the material described in this paper. Oil content of copra was estimated in 39 samples belonging to different crosses (table 1), and the mean values obtained are as follows:

1. *Typica* x *nana* form *pumila* 68.6% (mean of 19 samples)
2. *Typica* x *nana* form *eburnea* 68.0% (mean of 10 samples)
3. *Typica* x *nana* form *regia* 69.4% (mean of 10 samples)

Although the sample size is too small for definite conclusions it would appear that *typica* x *nana* form *regia* hybrids have a slightly higher oil content than the other two. However, the difference is not statistically significant, (table 2(c).). As the between crosses item is significant ($P<0.05$) for two economic characters, weight of copra per nut and oil content, (table 2 b & c), caution must be exercised in the choice of parental material that is used for production of hybrids as has been suggested by Satyabalan and his colleagues (1968).

The oil content of copra from *typica* x *nana* hybrids has not been studied to any great extent although Satyabalan (1956) mentions that natural cross *dwarf* x *tall* hybrids yield 68—70% oil.

A fuller investigation of all the nut characters of *typica* x *nana* form *pumila* is now being carried out by the Division of Chemistry of this Institute and the findings would be published in due course.

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REFERENCES

Liyanage, D.V. 1955 *Ceylon Cocon. Q.* **6,** 24
Liyanage, D.V. 1956 *Ceylon Cocon. Q.* **7,** 45.
Liyanage, D.V. 1958 *Ceylon Cocon. Q.* **9,** 1.
Manthriratna, M.A.P.P. and Liyanage, D.V. 1960 *Ceylon Cocon. Plrs. Rev.* **1,** (2): 3.
Manthriratna, M.A.P.P.: 1971 *Ceylon Cocon. Q.* **22,** 107.
Satyabalan, K. 1956 *Indian Cocon. J.* **9,** 166.
Satyabalan, K. Ratnam, T.C. and Menon R.M. 1968 *Indian J. agric. Sci.* **38,** 155.
Satyabalan, K. Ratnam, T.C. and Kunjan. P.V. 1970 *Indian J. agric. Sci.* **40:** 1088.

Table 1 Nut Characteristics of F_1 Progeny

	Cross and Progeny No.	*Wt. of husked nuts (g)*	*oil content (Percent)*	*Wt. of copra per nut(g)*	*Wt of husk (g)*	*Wt. of shell(g)*
Typica x *nana (form pumila)*	418x45–610	9,128	68.57	205	508	176
	,, –717	7,795	68.41	120	367	188
	,, –688	5,365	67.55	193	381	185
	59x36–609	9,886	66.98	223	518	177
	,, –627	5,540	66.89	237	700	179
	,, –676	7,178	67.42	197	444	194
	,, –799	8,720	69.65	206	440	155
	,, –747	9,099	69.42	219	600	221
	,, –705	9,771	68.82	222	433	133
	69x47–581	9,733	66.83	221	544	201
	,, –587	6,409	68.63	217	386	168
	,, –614	13,699	68.80	241	487	149
	,, –716	10,220	67.28	234	441	172
	,, –847	7,946	—	248	448	163
	,, –855	2,585	69.95	181	664	172
	215x36–638	6,034	68.08	222	339	148
	,, –658	9,979	70.47	221	532	160
	,, –665	7,832	68.15	218	501	183
	,, –685	6,951	69.90	230	450	166
	,, –800	3,466	71.13	200	605	196

Table 1 Nut Characteristics of F_1 Progeny

(Continued)

	Cross and Progeny No.	*Wt. of husked nuts (g)*	*Oil content (Percent)*	*Wt. of copra per nut(g)*	*Wt. of husk (g)*	*Wt. of shell(g)*
Typica x *nana* (form *eburnea*)	59x493–679	10,234	68.09	206	497	153
	,, –583	3,635	65.59	186	329	154
	,, –642	4,299	66.89	214	314	150
	207x584–546	6,848	68.03	190	341	143
	,, –586	4,680	65.94	218	379	148
	,, –740	9,574	68.96	236	393	161
	,, –821	7,722	66.47	200	276	145
	570x584–714	4,013	69.05	233	471	157
	,, –743	12,952	70.23	205	341	144
	,, –749	3,411	70.35	240	504	181
Typica x *nana* (form *regia*)	285x476–543	7,493	70.02	218	494	201
	,, –620	5,614	70.88	158	375	143
	,, –684	6,523	68.69	185	374	146
	,, –673	4,606	69.61	200	418	154
	,, –851	3,257	68.43	250	516	190
	240x527–536	3,465	69.67	208	447	141
	,, –634	3,602	70.16	240	535	172
	,, –597	7,845	68.49	236	481	186
	,, –657	3,364	69.58	240	487	184
	,, –707	4,700	68.62	228	530	165
MEAN VALUES						
Typica x *nana* (form *pumila*)		787	68.57	213		
Typica x *nana* (form *eburnea*)		673	68.00	213		
Typica x *nana* (form *regia*)		504	69.41	216		

Table 2 Analysis of Variance—(a) Wt. of husked nuts (g)

Source	*D.F.*	*S.S.*	*M.S.*	*V.R.*
Bn. Types	2	53283085	26641542	11.89**
Bn. Crosses wn. types	6	13449613	2241602	—
Bn. Individuals wn. Crosses	33	290037584	8789018	

(b) Wt. of copra/nut (g)

Source	*D.F.*	*S.S.*	*M.S.*	*V.R.*
Bn. Types	2	93	46.50	—
Bn. Crosses wn. types	6	8684	1447.33	2.89*
Bn. Individuals wn. Crosses	33	16525	500.76	

(c) Oil Content

Source	*D.F.*	*S.S.*	*M.S.*	*V.R.*
Bn. Types	2	10.70	5.355	1.42
Bn. Crosses wn. types	6	22.70	3.783	2.47*
Bn. Individuals wn. Crosses	32	49.02	1.532	